

Task 6.5 Final Report

WS 17-06

Modified in Montreal

Meeting #5 3/18-22/02

TASK 6.5 WS 17-06 Final Report

Task Description: Identify Design Requirements to Mitigate Problems of Aging in Wire Systems

Background:

Intrusive Inspection Working Group (IIWG) under an assignment and direction from Aging Transport System Rulemaking Advisory Committee (ATSRAC) had conducted an intensive detailed visual inspection of wiring system components on six decommissioned airplanes. This was followed by on airplane non-destructive testing and laboratory analysis. The results of these detailed visual inspections, non-destructive testing and laboratory analysis were used to determine the state of wiring system on aged aircrafts. The final report of the group to ATSRAC contained 28 specific recommendations.

Based on the IIWG report ATSRAC established a new Task Group (Task Group 6). One of the tasks assigned to this group was as follows.

“Identify requirements for FAR 25/JAR 25 new wire system rule taking into account known mitigation procedures that will decrease problem due to aging. These requirements should be based on the ATSRAC recommendations contained in the Intrusive Inspection Report, Chapter 7, dated January 7, 2001 as well as other ATSRAC recommendations”.

Discussion:

Task Group 6 formed nine groups and assigned specific tasks to each group. The above-mentioned task was assigned to Task Group 6.5. The team members for the Task Group 6.5 are:

Member Name	Affiliation
Ashok Bhattacharya (Task Leader)	Boeing Commercial Aircraft
Dave Allen	SAE
Jean-Luc Ballenghien	AIRBUS
Jerôme Bruel	JAA/DGAC-F
Walter Cinibulk	TYCO Electronics
Ken Elias	ALPA
Dave Harrison	British Airways
Issa Ghoreishi	Boeing Commercial Aircraft
Peter Glamoclija	Bombardier
Aldo Pezzetta	Dassault Aviation
Michael Richardson	Cessana Aircraft
Patrick Ryan	Thales Avionics
Steve Slotte	FAA
Peter Teichert	JAA/LBA
Dave Tudor	JAA/CAA
Vidmantas Variakojis	Boeing Commercial Aircraft

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The Task Group 6.5 reviewed the recommendations contained in the Intrusive Inspection Report, Chapter 7, dated January 7, 2001. In addition the team also reviewed the “concerns and issues” presented by JAA in the first team meeting.

In the context of this task the group agreed that the term “Aging” is not only related to time but also dependent on other factors. For this task the following definition of “aging” was used “Therefore, age includes the breakdown of inherent characteristics of wire as a function of time and the effect of maintenance, contamination, improper repair and mechanical damage”.

The group carefully and thoroughly examined each of the 28 items from IIWG and 20 items from JAA presentation. It was determined that some of the items were not relevant to the task assigned to this group and should be handled by one of the other groups.

A list of items that will be worked by Task Group 6.5 was developed and the following information was obtained for each item in the list.

- Does existing Regulation provide adequate coverage for the item?
- Does existing Advisory Circular cover the item?
- Is there need for new Regulation(s)?
- Is there need for new Advisory Material(s)
- Are there other groups who are affected by the item?

Based on the information gathered Task Group determined the need for new Regulation and/or new Advisory materials.

The Task group 6.5 recommended 15 regulations for new wiring sub-part to FAR/JAR 25 and 26 new advisory materials for the new AC/ACJ for EWIS.

Summaries of Task Group 6.5 findings are provided below in Table 1 and Table 2.

Recommendation:

For the circuit breaker reset policy, the FSDO issued Flight Standards Bulletins FSAW 00-08A, FSAT 00-07A, and FSGA 00-04A (Amended). It is our understanding that these bulletins have expired and we recommend that they be renewed.

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Item No.	Situation/Criteria	Remarks	Covered by Existing Rule	Covered by Existing Design/Advisory Circular	Need New Design/Rule	Need Advisory Materials	Other Groups Involved	Recommendations
1	Degraded Repair or Splice (Section 7.5.1)	How many splices should be allowed in a wire?	No	OEM Requirements & AC43.13-1B Section 11-167 exists	No	Yes	Task Group 8	<p>The following information is included in the new AC/ACJ for EWIS</p> <ol style="list-style-type: none"> 1. The environmental splicing is the preferred method for repair and or maintenance. 2. Only environmental splice now available uses heat shrink material that need application of heat but this heat gun should not be used on a fueled aircraft without proper precautions. 3. Maximum number of splices allowed per wire segment is three excluding any production splices. No permanent splice will be allowed on those system wires/ wire gages that are specifically prohibited by OEMs

Table 1: Design Requirements to Mitigate Aging Wiring Issues

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2	Degraded Repair or Splice (Section 7.5.1a)	This section is for "Potential heating condition due to degraded splice"	No	AC43.13-1B Section 11-167 exists	Yes	Yes	Task 8	<p>A new rule is drafted under sub-part 251705 to protect EWIS from heat damage.</p> <p>Corresponding Advisory Materials is included in the new wire AC/ACJ for EWIS</p> <p>Task Group 8 has already been informed regarding the recommendation of Task</p>
3 7.5.2. b, c,d,e, f	Heat Damage or Burnt Wire	Relatively common finding by AAIG Heat damage may cause wiring failure.	No	<p>OEM Requirements exists</p> <p>AC43.13-1B Section 11-124</p>	Yes	Yes	Task Group 9	<p>A new rule is drafted under sub-part 251705 to protect EWIS from heat damage.</p> <p>Corresponding Advisory Materials is included in the new wire AC/ACJ for EWIS</p>

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4	Vibration Damage/Chafing (Section 7.5.3a) and Vibration Damage/Chafing (Section 7.5.3e)	Relatively common finding by AAIIG. Special consideration for the High Vibration areas	No	OEM Requirements exists (also covered in SWPM). AC43.13-1B Section 11-96q, 11-97a	Yes	Yes	None	<p>The following statement is currently in FAR 251705 “...Be installed according to limitations specified for the EWIS components; and in a manner such that potential for abrasion/chaffing and vibration damage is minimized, and...”</p> <p>Advisory Materials for this is now included in the new AC/ACJ for EWIS</p>
5	Cracked Insulation (Section 7.5.4d) and Cracked Insulation (Section 7.5.4e)	<p>Relatively common finding by AAIIG</p> <p>Under certain conditions may cause multiple system failure.</p>	No	There are some wire damage information on OEM manuals	Yes	Yes	Group 9	<p>This item is covered under 25.1705 as follows “...EWIS components located in areas of known moisture accumulation shall be adequately protected to minimize any hazardous affect due to the moisture. ... ”</p> <p>Corresponding material is included in the new AC/ACJ for EWIS</p>

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6	Delamination (Section 7.5.5)	AAIIG finding was relatively infrequent	No	No	No	Yes	Group 9	<p>The following statement is added to the new EWIS AC/ACJ “The battery installation must provide protection for EWIS components from corrosive effects of Battery fluid.”</p> <p>In addition, revise FAR/JAR 25.1353(c)(4) to include EWIS as part of the section as follows “...No corrosive fluid or adjacent essential equipment including EWIS components.</p>
7	<p>Arcing (Section 7.5.6c)</p> <p>Arcing (Section 7.5.6d) and</p> <p>Arcing (Section 7.5.6e</p>	<p>AAIIG finding was relatively infrequent.</p> <p>Possibly beyond the scope of the Task Group 6</p>	No	Some OEM Requirements exists related to arc tracking properties of wire insulation	Yes	Yes	<p>Task Groups 8 and Task Group 9.</p> <p>R&D work is being done on Arc Fault Circuit breakers by FAA Tech Center and OEMs</p>	<p>The following is now covered in the new sub-part 25.1702</p> <p>“Cable shall be selected taking account of known characteristics in relation to particular installation and application to minimize the risk of cable damage including any arc tracking phenomena.”</p> <p>Appropriate information is included in the new AC/ACJ for EWIS</p>

Table 1: Design Requirements to Mitigate Aging Wiring Issues

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8	Current Rating	Wire property. Covered in wire specification (s)	No	AC 43.13-1B Section 5 and OEM specifications	No	Yes	No	Appropriate information for wire current rating is now included in the new AC/ACJ for EWIS.
9	Robustness	Much of this is covered by insulation type and installation practices	No	No	Yes	Yes	Task Group 8	<p>Information such as damage resistance & wire-to-wire abrasion is now covered by the proposed 25H1301(c).</p> <p>Cable robustness information as defined in “Proposal for Amendment to JAR Electrical Wiring Requirements” is included as compliance method(s) in new AC/ACJ for EWIS.</p>
10	Circuit Protection		FAR/JAR 25.1357	Yes	Yes	Yes	R&D work is being done on Arc Fault Circuit breakers by FAA Tech	FAR/JAR 25.1357 information is moved to the new subpart H. Appropriate compliance method(s) is included in the new AC/ACJ for EWIS.

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11	Fire Protection/Self Extinguishing Insulation	Wire property. Covered in wire specification (s)	FAR/JAR 25.869(a)(4)	OEM specifications	No	No	FAA Tech Center	A recommendation to ATSRAC will be included in our final report indicating that Appendix F and 25.869(a)(4) should be revised to reflect present industry standards.
12	Fire Resistance (fire zones)	Wire property. Covered in wire specification (s)	FAR/JAR 25.869(a)(2)	OEM specifications	Yes	Yes		Information regarding Fire Resistance as defined in 25.869(a)(2) is now included in new subpart H 25.1707. Appropriate information is included in the new AC/ACJ for EWIS.
13	Identification	Wire vendor identification is provided.	FAR/JAR 25.1301	Mostly covered by OEMs and in the SWPM. AC 43.13-1B Section 16 Cautionary Note: Some Identification methods may damage the wire insulation	Yes	Yes	No	Identification requirements developed by the group is now defined in the FAR/JAR new Sub part H Section 25.1706. In addition, advisory materials are included in the AC/ACJ for EWIS.

Table 2: Design Requirements to Mitigate JAA/CAA Issues and/or Concerns

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14	Accessibility	Wiring need to be accessible for easy inspection	No	No	Yes	Yes	None	<p>Wire accessibility requirement is covered under the new proposed FAR/JAR 25.1715.</p> <p>New AC/ACJ material for this item is included in the new AC/ACJ for EWIS</p>
15	Risk of Damage	Protection from damage due to failure of other devices (e.g. Control Cables) or by Maintenance / Repair personnel	FAR/JAR 25.1353	AC 43.13-1B 11-123, 11-124, 11-125 and OEM installation design requirements	Yes	Yes	None	<p>Risk of damage will be covered in the rule FAR/JAR 25.1705.</p> <p>A typical example of the proposed requirement is as follows:</p> <p>(i) EWIS systems must be designed and installed such that adequate separation exists between them and flight control system control cables and other flight control system components to prevent chaffing, jamming, or other interference.</p> <p>Advisory materials is included in the new wiring AC/ACJ for EWIS</p>

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16	Cable Temperature	Wire property. Covered in wire specification (s) – OEMs and Industry	FAR/JAR 25.1301	Indirectly covered in AC43.13-1B Section 5	No	Yes	None	Information regarding wire temperature rating and criteria to be used for selection of the correctly rated wire (150c etc.) is included in the new AC/ACJ for EWIS
17	Installation & Termination	Mostly process related and covered by OEMs in their process and SPWM manuals	No	OEM Specification Requirements and AC 43.13-1B Section 8 and other sections	No	Yes	Task Group 8	<p>The intent of this item is covered in the new FAR/JAR 25.1702</p> <p>New advisory material is included in the AC/ACJ for EWIS. The advisory material is based on the FAA wire policy that was released earlier this year.</p>
18	Segregation	This issue is being worked and addressed by various working groups	FAR/JAR 25.1353, 25.1309, 25.1333(a)(c) 25.1431(C) &	OEM Specification Requirements and AC 43.13-1B Sections 8, 10 and 11	Yes	Yes	Task Group 8	<p>Wire separation requirements are covered in detail in the new FAR/JAR 25.1705</p> <p>Compliance and guidance material is included in the new AC/ACJ for EWIS.</p>

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19	Voltage Rating	Wire property. Covered in wire specification (s)	No	Indirectly covered in AC 43.13-1B sections 5, 6 and 7	No	Yes	None	Information regarding wire voltage rating and criteria to be used for selection of the correct voltage rating for the application (600V AC etc.) is included in the new AC/ACJ for EWIS
20	Smoke	Wire property. Covered in some of the OEM's wire specifications	Indirectly covered by FAR/JAR 25.831	Some OEM specifications	Yes	Yes	None	<p>The following requirement with respect to wire and cable only (not the other EWIS components) is included in the new FAR/JAR sub-part 25H.</p> <p>“Electrical equipment should be so constructed and/or installed that in the event of failure, no hazardous quantities of toxic or noxious (e.g. smoke) products will be distributed in the crew or passenger compartment.”</p> <p>Advisory material for this item is included in the new AC/ACJ for EWIS.</p> <p>It was agreed that the rule should not be released without corresponding AC materials.</p>

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21	Toxicity/By-Products	Wire property. Covered in wire specification (s)	No	Some OEM specifications	Yes	Yes	None	Information is included in the new FAR/JAR sub-part H. Please See recommendation in item 20 above.
22	Arc Tracking	Wire property. Covered in some of the wire specification (s)	No	Some OEM specifications	Yes	Yes	FAA Tech Center and OEMs	<p>The following requirement is included in FAR/JAR sub-part H as a regulation “Cable shall be selected taking account of known characteristics in relation to particular installation and application to minimize the risk of cable damage including any arc tracking phenomena.”</p> <p>Appropriate information is included in the new AC/ACJ for EWIS</p>

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23	CB Reset	Part of Aircraft Flight Manuals	FAR/JAR 25.1357 and possibly FAR 121	OEM/ ALPA requirements and Partially covered in AC 43.13-1B Section 4	No	Yes	Task Group 8	<p>This is an operational issue. FSDO has release a bulletin on circuit breaker resetting. (Reference: Flight Standards Bulletin: FSAW 00-08A, FSAT 00-07A, and FSGA 00-04A (Amended))</p> <p>This bulletin has expired, so we agreed to include a recommendation in our final ATSRAC report that the bulletin be renewed.</p>
24	Modification and Repair	By airlines, repair stations, alteration stations and STC	In general needs to comply with FAR and JAR requirements	OEM Standard Wiring Practices Manuals and AC25-16, AC 43-13	No	Yes	Task Groups 8	<p>All new FAR/JARs developed by Task group 6 are equally applicable to modifications. Appropriate information will be included in new AC/ACJ for EWIS.</p> <p>Our final report to ATSRAC will include our concern about repair stations.</p>

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25	Cable to Cable Abrasion	Wire Insulation property	No	OEM wire specifications	No	Yes	Task Groups 8 and Task Group 9	<p>The proposed FAR/JAR Sub-part 25.1702 covers damage resistance such as wire to wire abrasion.</p> <p>Compliance method(s) are included in the new AC/ACJ for EWIS.</p>
26	Red Plague Corrosion	Specific to a particular wire conductor and insulation	No	No	Yes	Yes		<p>The new FAR/JAR, 25.1702 includes the following requirement - "EWIS Components located in areas of known moisture accumulation shall be adequately protected to minimize any hazardous affect due to the moisture."</p> <p>Compliance methods are included in the new wire AC/ACJ for EWIS.</p>
27	Glycol Fires	Specific to a particular wire conductor and insulation	No	No	No	Yes		<p>The new wire AC/ACJ for EWIS will include some words that address the potential for combustion when glycol/water combinations come into contact with sliver plated wires.</p>

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